

## Filter Strip - Animal Waste Management (Acre) 780

### DEFINITION

A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff water associated with livestock operations.

### PURPOSES

To remove sediment and other pollutants from runoff associated with livestock operations by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization; thereby reducing pollution and protecting the environment.

### CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) an overall waste management system has been planned and approved; (2) the area requires filter strips as part of the waste management system plan to treat polluted runoff; and (3) the area producing polluted runoff is less than one acre and contains less than 200 animal units (1 animal unit = 1,000 pounds live weight).

This practice does not apply to Field Borders (386) or Filter Strips (393A).

### DESIGN CRITERIA

Filter strips shall be planned, designed, and installed to meet all federal, state, local and tribal laws and regulations.

These criteria apply to filter strips for feedlot and barnyard runoff where the facility confines less than 200 animal units (1 animal unit = 1,000 pounds live weight) and the drainage area contributing to the filter strip does not exceed 1 acre.

The outlet of a filter strip shall be located a minimum of 150 feet from surface waters.

Filter strips shall not be constructed within an area known to be frequently inundated with floodwater or that typically has water within one foot of the surface during the growing season.

Filter strips must be fenced to limit access and control grazing.

The filter strip shall be a relatively uniform grassed area or grassed channel. Filter strips shall be designed for natural or constructed slopes of 0.3 to 6 percent. The first 100 feet at the upstream end should not be flatter than 1 percent. Where constructed slopes are required, salvage existing topsoil and spread at final grade. Minimum dimensions shall be based on the peak inflow rate resulting from a 2-year, 24-hour rainfall. If the discharge is controlled by an outlet structure, the minimum dimensions shall be based on the design release rate resulting from a 2-year, 24-hour rainfall.

Use the equation below to compute the peak discharge from the contributing drainage area.

Peak Discharge  $Q_p$  (cfs):

$$Q_p = R \times A \times 0.000036$$

$R$  = Runoff depth (in.)

Compute using 2-year, 24-hour rainfall and curve number of 90 for unpaved areas and 95 for paved areas

$A$  = Lot runoff area (sq. ft.)

A level spreader, gated pipe, sprinklers, or other facilities shall be provided across the upstream end of the filter strip to establish sheet flow.

**Grass area (overland) filter strips** shall be generally on the contour and sufficiently wide to pass the peak flow at a depth of 0.5 inches or less. Flow length shall be sufficient to provide at least 15 minutes of flow-through time. Flow-through time equals the filter strip length divided by the average velocity. Manning's equation with an "n" value of 0.3 shall be used to determine average flow velocity.

**Grass channel (channelized) filter strips** shall be designed to carry the peak flow at a depth of 0.5 feet or less with a Manning's "n" value of 0.25. The channel cross-section shall be trapezoidal. Maximum bottom width shall be 40 feet and side slopes shall be 8:1 or flatter. Flow length shall be sufficient to provide at least 30 minutes of flow-through time.

To minimize the development of flow concentrations that will short-circuit the sheet flow needed to maintain the effectiveness of the grass filter channel, rock checks will be installed at 100-foot intervals along the length of the channel.

A rock check is a shallow trench filled with MDOT 22A or 23A coarse aggregate. The trench should be 1 to 1.5 feet deep, extend 2 to 4 feet in the direction of flow, and extend the full width of the channel up to the design depth. The top of the stone in the trench should be flush with the bottom of the channel. Crushed limestone is preferred to enhance phosphorus immobilization, but is not essential.

A settling basin or low velocity channel shall be provided between the waste source and filter strip when more than 25 animal units (1 animal unit = 1,000 pounds live weight) are confined. Such settling facilities should be considered for use with all filter strips. When lot runoff is allowed to directly enter the filter strip (no settling basin or low velocity channel), the filter strip length shall be increased to 150 percent of the design flow length.

A constructed settling basin used for settling solids shall have sufficient capacity, as a minimum, to store the runoff computed for 15 minutes duration at the peak inflow rate resulting from a 2-year, 24-hour rainfall. Any basin outflow shall be disregarded in computing minimum storage. Additional storage capacity, based on frequency of cleaning, shall be provided for manure and other solids settled within the basin. Use the waste volume produced for the time period between clean-outs to determine the additional storage needed. The settling basin should be outside the livestock area, where possible.

A low velocity channel used for settling solids shall be a minimum of 75 feet long. It shall be designed for a flow depth of 0.5 feet or less to pass the peak flow resulting from a 2-year, 24-hour rainfall at a velocity of 0.5 feet per second or less. Include a concrete or other stable bottom, access points, and

other provisions as necessary for removing settled solids from the channel to maintain proper functioning. Provisions shall be provided at the outlet end of the low velocity channel that will prevent solids from flowing into the filter strip.

Drainage, both surface and subsurface, may need to be provided to maintain an aerobic rooting zone. Where the grade permits, outlet subsurface drains from the upstream end of the filter strip onto a rock check farther downstream in the filter strip.

Direct discharge of leachate from solid stacking facilities onto a vegetated filter strip may be allowed when discharge to a holding pond is not practicable because of high water table or other technical reasons. Dilution of the leachate is required. The amount area contributing runoff to dilute the leachate should be determined as follows: (1) if the runoff for dilution will be relatively clean such as roof runoff, pasture runoff, or runoff from a frequently scraped, paved loafing area/feed lot, the area contributing dilution runoff must be at least as large as the total area of the solid stacking structure (1:1 ratio); or (2) if the runoff for dilution will be relatively nutrient rich such as an earth loafing area/feed lot or an infrequently scraped loafing area/feed lot, the area contributing dilution runoff must be at least twice as large as the total area of the solid stacking structure (2:1 ratio). The runoff water used to dilute the leachate shall be combined with the leachate in the settling basin/area at the upstream end of the vegetated filter.

Runoff should be diverted away from the filter channel until the vegetation is well established. A minimum height of 4 inches and 90 percent ground cover is desirable. Refer to Table 1 for appropriate seed mixtures.

**Seeding Mixtures and Rates** - Select one of the seed mixtures in Table 1, depending on soil type and drainage conditions.

**TABLE 1 - Vegetative Mixtures for Filter Strips -  
Animal Waste Management**

**Soils - Well and moderately well drained sand and loamy sand (coarse textured soils)**

Seeding Mixtures	Rate (Lbs./Acre)
1 Red Fescue	40
Ryegrass	10
2 Smooth Brome	30
3 Orchardgrass	24

**Soils - Well and moderately well drained moderately coarse to fine textured soils (sandy loam, loam, silt loam, clay loam, silty clay & clay)**

Seeding Mixtures	Rate (Lbs./Acre)
1 Reed Canarygrass	12
2 Reed Canarygrass	8
Tall Fescue *	16
3 Smooth Brome	30
4 Smooth Brome	16
Tall Fescue *	24
5 Tall Fescue *	40
6 Orchardgrass	24

**Soils - Somewhat poorly drained or poorly drained soils without artificial drainage**

Seeding Mixtures	Rate (Lbs./Acre)
1 Reed Canarygrass	12
2 Tall Fescue *	40
3 Garrison Creeping Foxtail	15

\* Do not include tall fescue if area is planned for grazing or forage.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species, for plant materials identified as invasive species.

**CONSIDERATIONS**

Consider the potential effects of installation and operation of filter strips on the cultural, archeological, historic and economic resources.

Evaluate type and quantity of pollutant, surface geology, groundwater depth, length and percent slopes, soil infiltration and percolation rate, adapted vegetative species, time of year for proper establishment of vegetation, necessity for irrigation, visual aspects, fire hazards, and other special needs as identified below.

1. Provide adequate soil drainage to ensure an aerobic soil profile that allows vigorous plant growth.
2. The outlet of a filter strip shall be located a minimum of 150 feet from surface waters.
3. Settleable solids shall be removed as much as practicable prior to directing flow to the filter strip. A settling basin or low velocity channel shall be provided between the waste source and filter strip when more than 25 animal units (1 animal unit = 1,000 pounds live weight) are confined.
4. Consider diverting polluted runoff until vegetation is established in the filter strip.
5. Remove settleable solids as much as practicable prior to directing flow to the filter strip.
6. Consider the ability of the landowner/operator to manage and operate the filter strip in accordance with the operation and maintenance plan.
7. Do not use filter strips as a travelway for livestock or farm equipment.
8. Exclude roof runoff water and outside surface runoff from flowing into the filter strip unless needed to dilute the polluted runoff prior to entering the filter strip.
9. Include provisions for mowing and removing vegetation to promote vigorous vegetative growth and maintain the effectiveness of the filter area. While not generally recommended, controlled grazing may be satisfactory when livestock traffic will not damage the filter area.

Filter strips by themselves will not meet the "no-discharge" requirement applicable to livestock operations requiring permits under the National Pollutant Discharge Elimination System. More stringent pollution abatement measures may also be necessary where receiving waters must be highly protected.

## PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

1. Support data documentation requirements are as follows:
  - Inventory and evaluation records
    - Assistance notes or special report
  - Survey notes, where applicable
    - Design survey
    - Construction layout survey
    - Construction check survey
  - Design records
    - Physical data, functional requirements and site constraints, where applicable
    - Soils/subsurface investigation report, where applicable
  - Design and quantity calculations
  - Construction drawings/specifications with:
    - Location map
    - "Designed by" and "Checked by" names or initials
    - Approval signature
    - Job class designation
    - Initials from preconstruction conference
    - As-built notes
  - Construction inspection records
    - Assistance notes or separate inspection records
    - Construction approval signature
  - Record of any variances approved, where applicable
  - Record of approvals of in-field changes affecting function and/or job class, where applicable

## 2. Construction Drawings

A complete set of construction drawings and specifications and a summary of important details, including:

- a) Size and slope of the filter strip.
- b) Dimensions of storage facility.
- c) Type of distribution and weekly loading rate.
- d) Soil amendments and methods of seedbed preparation.
- e) Species of vegetation and establishment method.

## 3. Protection During Establishment

Divert runoff water away from the filter area whenever possible during establishment until the vegetation is well established. A minimum height of 4 inches and 90 percent ground cover is desirable.

## 4. Seedbed

- a. Shape and prepare a firm seedbed in a manner consistent with environmental concerns and proper functioning of the filter strip.
- b. Spoil shall be spread where it will not interfere with the required flow characteristics of the filter strip.
- c. If necessary, shape the site so conventional equipment can be used for preparing the seedbed, seeding, fertilizing, and maintenance.

## 5. Vegetative Requirements - Seeding - Lime - Fertilizer

Vegetated filter strips shall be seeded according to Table 1 and limed and fertilized in accordance with specifications for the Critical Area Planting (342) practice standard.

## OPERATION AND MAINTENANCE

Provide an Operation and Maintenance Plan to the landowner or operator that includes the following items:

1. Protect the filter from damage by farm equipment, traffic, and livestock.
  - a) Do not use as a roadway.

- b) Avoid operations that leave wheel marks.
  - c) Avoid damaging filter areas with herbicides.  
When spraying for grass control on adjoining cropland, spray only when drift is away from filter strip.
  - d) Maintain the fence to limit access and control grazing.
2. Fertilize the filter according to a soil test every 3 years.
3. For maximum nutrient removal from the runoff water, vegetation must be maintained in a vigorous condition. Grass stems must remain upright during design flow. Annual mowing and harvesting of the forage is required.
- a) For cool-season grasses, mowing should occur between July 15 and August 15. For warm-season grasses, mowing should occur between June 20 and July 20. Vegetation height after mowing should not be less than 6 inches.
  - b) If livestock have access to the filter area, control the grazing to ensure harvesting of the vegetation and to prevent damage. Allow grazing, mowing, or any other access only when ground is dry enough to prevent rutting.
4. Re-seed areas where vegetation fails.
5. Development of rills and small channels from erosion, equipment, or other means within the filter area must be minimized. Needed repairs must be made immediately to reshape the area and re-establish sheet (overland) flow. Rake rock checks in filter channels at least annually to keep them level and remove any build-up of deposited materials. For overland flow strip filters, a shallow furrow on the contour across the filter can be used to re-establish sheet flow.
6. Brush and weeds are undesirable and must be controlled with herbicides or mowing. Use only those pesticides which are labeled for the specific use. Refer to Michigan State University publications and specific label instructions for guidance on pesticide selection and use.

## **Filter Strip-Animal Waste Management**

### **OPERATION & MAINTENANCE PLAN**

Inspections and maintenance are required to obtain the intended function and life of the animal waste filter strip. A maintenance program should be established by the land user to maintain capacity and vegetative cover. Items to inspect and maintain during the life of the filter strip are:

1. Follow your comprehensive nutrient management plan.
2. Keep livestock out of the filter area to maintain good grass cover.
3. Mow and fertilize grass or pasture areas downstream of filter strip to maintain a vigorous growth.
4. Do not use the filter strip as a travelway for farm equipment.
5. Keep filter strip free of manure build-up and standing water.
6. Mow the filter strip to maintain a dense stand of grass and reduce weeds. Remove the grass cuttings to remove nutrients from the filter strip area.
7. Keep unnecessary water out of the filter area. Inspect and maintain roof gutters, downspouts, and diversions twice a year. Filter strips built for treatment of water from stacking areas require clean water input. Do not remove clean water where it is required by the filter strip design.
8. Maintain gravel water spreaders by adding gravel and/or raking gravel spreaders smooth and level. The level area is required to force sheet flow.
9. Frequently inspect wood or concrete water spreader structures for plugging. Clean slots as needed.
10. Clean out settling basin when solids build up is greater than 6 inches deep.

11. Inspect concrete or wood spreader structures and settling basins twice a year for deterioration. Repair as needed.
12. Fill rills and small channels within filter areas promptly to promote sheet flow of wastewater. Reseed the filled areas.